

many cases is rather crude, and with the directions for the experiments which constitute the main part we are not well satisfied. Surely in a calorimeter experiment it is not well to have the water so high as 40° C., especially when a thermometer reading to fifths is used; and surely, also, it is bad science to teach a boy that he can ascertain the temperature of a Bunsen flame by heating a 32-gram mass of copper in it and transferring it to a calorimeter. If this is done, is he too young to be shown at the same time that a small bead of copper will get visibly hotter (judging from tint), and that even a very thin platinum wire will *melt* in a Bunsen burner? The temperature found in the experiment with the copper ball is less than 1000° C. The questions at the end of each chapter are the best things in the book. Many are based on phenomena with which the boy will have acquired familiarity in his sports and other amusements, and these will certainly encourage him to take an interest also in more serious pursuits; but the problem on the hanging of a man strikes one as rather too brutal for a school-book.

(3) The volumes by Mr. Jackson and Mr. Allen consist of collections of examples. Those brought together by Mr. Jackson are of an elementary character. There are about 600 classified according to the branches of physics to which they relate, and these are followed by fifty test papers of mixed problems, each paper containing about ten questions. Thus we have here about 1000 questions the order of difficulty of which reaches practically that of the intermediate examination in the University of London. This collection will certainly be welcomed by a large number of teachers under the Board of Education and in technical schools. The advanced questions have been so constructed as to lead to reasonable results. Answers are provided only to the classified questions.

(4) The collection made by Mr. Allen is of a much more advanced character, viz., that of a final pass or honours degree in physics. The problems are selected in the main from examination papers set by the London and Victoria Universities. Answers are given, and these the present reviewer proceeded to test, but he had omitted to observe an introductory note by Prof. W. Stroud:—

"Answers are appended to the problems. This is the only feature of the book I rather regret, but they are inserted in the interests of private pupils. I should be delighted if only some of the answers were *wrong*, so that students (whose notion of working examples is to juggle with the numerics in a question so as to get the numeric in the answer) might be righteously confounded, but I have no hope; for Mr. Allen's carefulness and exactitude are such that in his preface he does not even tell the users of his book that 'any corrections to the answers will be gratefully received.'"

We commend the book as an aid to the simplification of the work of a teacher, but at the same time we hope that it will not encourage him to put altogether aside the labour of compiling his own problems based on his own experiments and study. Such examples are of far greater value both to teacher and pupil.

(5) With the aim which the writers of this volume

have set before themselves we have very full sympathy. It is certain that the academic method of teaching physics tends to discourage a certain class of boy from paying any attention to his subject. To remove this fault a less formal method is desirable, especially in schools. Ultimately the youth who desires a sound knowledge must be willing to learn by logical methods, for it is by these *only* that accurate ideas can be acquired. But unless he is a born student his interest must first be aroused. He must be led to see that an intelligible account can be given of the mode of action of many of the puzzling phenomena which surround him; he must learn that things with which he has been familiar are not events isolated completely one from another so that each has no bearing on the other, but that a knowledge of one contributes to his knowledge of another. In this way a desire for further knowledge is awakened.

We have also considerable sympathy with the way in which this aim is carried out. Their book is full of illustrations, largely from half-tone blocks—motor-cars and express trains in full motion, eight-oared shells, *small* engine attached to *short* train, looping the loop, charming children swinging on a gate (so different from the ordinary wood-cut children), photographs of real ripples on a pond, engines, turbines, and other machinery, the lifting-magnet with its five-ton load of iron, mining coal with compressed-air drill—these are some that meet the eye as the pages are rapidly turned over. Sometimes, indeed, the application seems rather indirect. Thus a half-tone figure of a man hard at work on the top of a haystack is labelled, "Haying: A man cannot work unless he consumes food." But, even in such a case, the picture is clearly intended merely to call up a series of real events, and not to portray any one with brutal accuracy. History is also called upon to contribute; knowledge has only gradually been acquired. The boy gets an idea of its growth; the "heroes" of science are introduced to him (but without portraits!).

All this is excellent, and will work well. Our only regret is that so much accuracy had to be sacrificed in the text in order to carry out the scheme completely. Is not it better, perhaps, to postpone the explanation of some things until a safe foundation for true knowledge has been obtained? The pupil will require to unlearn many of the statements made here, and this will certainly induce a period of distrust. *Some will never unlearn them.* However, the suggestion that a book of this kind might be better curtailed is the only critical one we have to offer.

MANUFACTURE OF ALUMINIUM.

The Production of Aluminium and its Industrial Use.

By Adolphe Minet. Translated, with additions, by Leonard Waldo. Pp. vi+266. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 10s. 6d. net.

THIS book brings together the theory and practice of the aluminium industry in a complete and readable form. It commences with a more or less

detailed and historical survey of the chemical processes which were employed before the metal was produced upon a commercial scale by the aid of the electric current. The successful chemical processes which were all based upon the reduction of salts of aluminium with sodium and were simply modifications of the method used by Wöhler in 1827, when he discovered the metal, brought first and foremost in their train the remarkable cheapening in the manufacture of sodium; because unless sodium could be obtained at a low cost it was impossible to manufacture aluminium cheaply. However, by purely chemical processes it was never found possible to produce aluminium below about thirty shillings per kilo. In fact, in 1889 the price was 38s. per kilo., but at the end of 1891, soon after the advent of successful electrolytic processes, it had fallen to 5s., and at the present day it is rather less than 2s. per kilo.

Minet describes the electrical and electrolytic methods in chronological order. To the brothers Cowles, of America, belongs the honour of first producing a working furnace in which they were able to obtain alloys of aluminium with other metals, by striking an arc in a mixture of bauxite and oxide of iron or other metal. The Héroult seems to have been the first furnace in which a fused aluminium salt—cryolite—was actually electrolysed on a commercial scale, and modifications of this furnace are at the present day among the most successful which are employed, and the one worked by the British Aluminium Co. at Foyers is a Héroult. The production of aluminium is essentially one of electrolysis, but it is also electrothermic in so far as the passage of the current serves to keep the bath molten. The bath usually consists in the first place of fused cryolite, and as the electrolysis continues the loss of aluminium is replaced by additions of aluminium fluoride or of alumina. If the bath were regenerated by continual additions of cryolite, in time the quantity of sodium fluoride would become excessive, and sodium and not aluminium would be yielded up at the kathode.

Most authorities consider that in a bath which is regenerated with alumina the alumina and not the fluoride undergoes electrolysis. Minet, however, considers that it is the aluminium fluoride which undergoes electrolysis, and that the fluorine given up at the anode continuously reproduces cryolite.

Part ii. deals with "aluminium and its alloys." In this the author deals with the cost of the production of aluminium and its alloys. Aluminium is perhaps of more general use in the form of its alloys than in the pure condition. We see that Minet mentions its use in the pure state for surgical instruments—woe betide these instruments if antiseptised in mercuric chloride.

A few very interesting pages are devoted to the employment of aluminium as a reducing agent, in the production in the pure state of such metals as chromium, vanadium, manganese, &c., and also for welding purposes. Minet states that ingots of chromium weighing 100 kilos. are prepared at Essen in one charge, and the production of this quantity of metal is said to take only twenty-five minutes.

The translator contributes a short appendix upon

"Aluminium in the United States." The book may be heartily recommended as a very useful contribution to the subject.
F. M. P.

PETROL MOTOR-CARS.

Motor-car Mechanism and Management. In three parts. Part i. The Petrol Car. By W. Poynter Adams. Pp. x+174. (London: C. Griffin and Co., Ltd., 1906.) Price 5s. net.

THE author states that his object is to put into the hands of owners and drivers of motor-cars in a convenient and handy form some knowledge of the general mechanical principles which ought to be understood by those who drive them.

This idea has been carried out very fairly. The early chapters on the engine and on the various organs are treated in sufficient detail, and although there are a few blemishes and mistakes, these are not of any considerable importance.

When, however, the author deals with a matter which is extremely difficult for the average car-owner or driver to understand—namely, the understanding and care of the electrical accessories, which are now everywhere used—we can have nothing but praise for the very thorough manner in which this very difficult question has been dealt with; in fact, it is evident that the author is a trained electrical engineer, and has consequently been able to approach this subject from the standpoint of one who has had to explain the nature of electrical developments to the ordinary user of electric apparatus. We think the author's short and concise descriptions of the various sources of electrical supply which are now available, his definitions of conductors, insulators, and other electrical terms which must be used to make his explanations intelligible, are so good and so well arranged that they should be read by anyone who wishes to obtain a bird's-eye view of electrical engineering so far as it applies to ordinary users of electric light and power; at any rate, it is certain that the average user of the modern motor-car finds himself very frequently at fault when he has to puzzle out stoppages on the road due more to the failure of his electrical accessories than to any other cause, except perhaps that of the universal bugbear, the care of the pneumatic tyres.

On p. 85, when mentioning the importance of a good compression in order to get economical working of the engine, the author makes statements which are liable to mislead the user when he says that 37 per cent. of the full value of the charge is transformed into useful work, and that if the compression is increased to 100lb. this may be increased to 45 per cent. We find no note correcting this by explaining how this refers to a perfect engine, and that with such forms of internal combustion engines as are used for cars not more than 50 per cent. of such efficiencies are likely to be realised.

At the present day, when so much is being said as to the want of courtesy and consideration for other users of the road by the drivers of motor-cars, the author's remarks from p. 15 to the end ought to be read by everyone who drives a car.